arisen, if, as usually supposed, all the species of a "genus" have descended from a common ancestral for each genus, in the one case four-branched, and in the other case two-branched. On the other hand, it is comparatively easy to explain the more or less simultaneous existence of forms possessing the same number of stipes, but otherwise only distantly related, if they are different ancestral types. Phenomena somewhat analogous have been detected amongst the species of Ammonites and Brachiopods. Following these inferences to their legitimate conclusion, the authors point out how "genera," like *Diplograptus* and *Monograptus*, may contain representatives of more than one "family" of graptolites according to the classification now in vogue, which would account for the great diversity in the characters in the monograptid hydrothecæ.

Messrs. Garwood and Muir followed with a paper on the zonal divisions of the Carboniferous system. The following zones are recognised by them :—

Zone of *Productus* c.f. *edelburgensis*.
,, ,, *latissimus*.
,, ,, *giganteus*.
,, *Chonetes papilionacea*.
,, *Spirifera octoplicata*.

Mr. Garwood has traced the zone of *P. latissimus* occupying the same position relative to that of *P. giganteus* from Settle, in Yorkshire, to the Northumbrian coast, near Howick Burn. In conclusion, the authors hope that their work may be continued by a Committee, and one was appointed by the Section and confirmed by the General Committee of the Association.

Prof. T. Rupert Jones, in the twelfth report on Palæozoic Phyllopoda, gave a *résumé* of these organisms referred to in previous reports, and appended some valuable notes and two tables by Prof. Lapworth, of which the first gives a general correlation table of the Lower Palæozoic rocks; the second, the horizons of the chief species of Phyllopods. A third table gives a list of the geological order of species. After hearing interim reports from the Committees on Eurypterids, and on type specimens, the Section listened to a paper by Dr. Woodward on Decapod Crustaceans from the Cretaceous rocks of Vancouver, in which the following new species were described. *Callianassa Whiteavesii*, *Palæocorystes Harveyi*, *Plagiophthalmus (?) vancouverensis*, and *Homolopsis Richardsoni*. Many of these forms approach contemporaneous European types. The closing report was that on erratic blocks. The Yorkshire Boulder Committee and that of the Hull Geological Society are promoting a systematic survey of the ground. New work has also been done in Lincolnshire, Shropshire, Cheshire, South Wales, and Ireland.

A very pleasant feature of this year's meeting has been a series of afternoon walks or drives, carefully planned by the Local Secretary, Mr. Ridley; in many of these the President took the leadership, and several members of the Section attended. The list of these included Bramford, Sproughton, Orford, Sudbourne, Butley and Chillesford, Woodbridge and Sutton, Tattingstone, Bawdsey, Foxhall, and Cromer. At several of these localities the sections had been freshly scarped or reopened by the Local Committee and by the landowners. It is much to be hoped that in future similar opportunities may be afforded of acquiring as full a knowledge of the geology of the neighbourhood in which the meeting is held.

ZOOLOGY AT THE BRITISH ASSOCIATION.

As this Section was occupied with dredging excursions on the Saturday and Wednesday, only four days were available for sectional meetings, and as the number of papers and reports to be discussed was large (nearly fifty), the sittings were continued late into the afternoon. The majority of the papers dealt with marine zoological subjects, and fishery questions received special attention.

After the President's address on Thursday, the following reports of Committees were taken :—

On the marine zoology, botany, and geology of the Irish Sea. The report deals with nine dredging expeditions held during the past year, and discusses the additions made to the known fauna. Statistics of the dredging results are given to show (1) the relative richness, per haul, of the shallower over the deeper waters, and (2) the relatively large number of genera represented by the species in one haul; pointing to the conclusion that, as a rule, allied species are not found together. The submarine deposits round the Isle of Man, and the currents of the Irish Sea are also discussed.

On the migration of birds. The nine years' observations are now being tabulated for presentation at next meeting.

Investigation of the zoology of the Sandwich Islands. Valuable collections are being made and brought home, and unless these are made now they can never be done, as the extinction of much of the present fauna is not only inevitable, but will be immediate.

Research at the Zoological Station at Naples. The British Association table has been occupied by Mr. M. D. Hill, who has been investigating the maturation and fecundation of the ova of Echinodermata and Tunicata.

Research at the Marine Biological Laboratory at Plymouth. This Committee have enabled Miss Florence Buchanan to work out the blood-forming organ in the larva of Magelona; Mr. E. J. Allen to work on the nervous system of the embryonic lobster; and Mr. Sumner to work at the Echinoderm fauna of Plymouth.

Investigation of the fauna and flora of the West Indian Islands. The Committee reported upon the progress made in working up the collections.

On an Index Generum et Specierum Animalium. In Mr. Sherborn's hands the Index is making satisfactory progress.

On the physiological applications of the phonograph. The Committee are studying the marks on the cylinder of the phonograph by microphotographs and by recording curves, and they propose to make these available for philological purposes in the study of dialects.

The following papers were then taken :—

On the Stereornithes, by C. W. Andrews. They are a heterogeneous group of extinct birds, found in Patagonia, whose chief points of resemblance lie in their large size and reduced power of flight. Some of them, at least, have no special affinities with the living Ratitæ. They are not represented in European museums.

Facts and reflections on budding in compound Ascidians, by Prof. W. E. Ritter (California). The author argues for the polyphyletic origin of the compound Ascidians; he considers that there is no homologue of the "epicardium" of *Clavelina* in either *Goodsiria* or *Botryllus*; he suggests that budding has arisen in small Ascidians as a compensation for diminished power of sexual reproduction; he believes that physiological necessities have modified the course of development by budding, so that the endoderm now produces some organs originally formed from ectoderm.

A new classification of the Tunicata, by W. Garstang. The author gave his reasons for proposing to modify the classifications given by Herdman and by Lahille, by adopting some of the features of each scheme. In the main he proposes to follow Herdman in the primary divisions, and Lahille in the subdivisions. He considers *Pyrosoma* to be related to the pelagic forms, such as *Salpa*, and not to the fixed Ascidians. He makes use of the branchial sac largely in classification. This paper gave rise to an interesting discussion.

On the presence of skeletal elements between the mandibular and hyoid arches of *Hexanchus* and *Læmargus*; and on the presence of a sternum in *Hexanchus griseus*, by Dr. P. White.

On the Creodonta, by Prof. W. B. Scott. This and some of the other papers gave rise to considerable discussion, and the Section did not adjourn till about five o'clock.

In the course of the day's proceedings it was moved by Prof. W. A. Herdman (President of the Section), seconded by Dr. P. L. Sclater (past-President), and carried unanimously, that the zoologists of this Section desire to present to Dr. John Murray their congratulations on the completion of the *Challenger* publications, and their best thanks for his splendid services to science. This resolution was duly conveyed to Dr. Murray, and a letter of thanks from him was received by the Section later in the meeting.

Friday was devoted to papers and discussions on the marine fisheries. Prof. McIntosh led off with a paper on some of the results of scientific investigations as applied to the fisheries. He gave a useful summary of what had been effected by the Scottish Fishery Board; he showed that the three-mile limit was insufficient to protect the spawning fishes, and in conclusion urged that scientific investigations on the fisheries should be carried out by Government and not be left to Universities.

Prof. Haddon followed with a report on the Royal Dublin Society's Fishery Survey, and also gave an account of the Fishery School at Ringsend, near Dublin. He pointed out the special conditions of the Irish fishery grounds, the lack of access to markets and of fish-curing stations on the west.

Dr. Bashford Dean (U.S. Fish Commission) gave an account of oyster-cultural methods, experiments, and new proposals. He pointed out the difficulties in "spat" collecting, and showed that if these could be overcome the problem of raising oysters successfully would be solved. He dwelt on the effects of bad aeration, and of changes of temperature, and on the difficulty in retaining the embryos in closed areas, such as the *mare piccolo* at Taranto and the Brénéguy lake in France. Finally he discussed the cultural methods recently patented in the United States.

Prof. W. A. Herdman and Prof. R. Boyce gave a paper on oysters and typhoid, in which they explained the investigations they had made on the normal and abnormal life-conditions of the oyster, including the effect of pathogenic organisms. The oysters were laid down in various kinds of water, and fed on a variety of substances, both in the laboratories at Liverpool and also at the Port Erin Biological Station. Some of the results obtained are: the beneficial effects of aeration, the superiority of natural food (protophyta, &c.) over artificial (oatmeal, &c.), the deleterious effects of stagnation, great toleration of sewage, inimical effect of typhoid fæcal matter, the identification of *Bacillus typhosus* in oysters fourteen days after infection. The observations are still in progress, and a Committee of the British Association has been formed for the purpose of carrying on the investigation.

Dr. H. C. Sorby read a paper on the oyster culture in the Colne district, which was to be visited by a party of zoologists from the Section the Wednesday following. He described the grounds where spat was obtained, and the celebrated Pyefleet creek where the "natives" are fattened for the market.

Mr. J. T. Cunningham gave the last of the fishery papers, on fish and fishing grounds in the North Sea. This author disputed the idea that the great quantities of young plaice in the eastern parts of the North Sea are derived from the spawn and embryos carried across by currents, and that these plaice when they grow large supply those parts of the North Sea that lie further west. He suggests that the plaice on the German side are a smaller race, and that they correspond in distribution to a tract of warmer Atlantic water. He urged the necessity for a scientific investigation of the North Sea fisheries, and for experiments in rearing young food fish in artificial ponds. A discussion followed, in which the authors of the papers, the President, Mr. Alward, Mr. A. O. Walker, and others took part.

In the afternoon a discussion took place on zoological bibliography, opened by Dr. Haviland Field with an account of his scheme for the establishment of an international bibliographical bureau, to be located at Zürich. The organisation is now nearly completed, and the bureau is expected to start work in January 1896. Dr. Field asks England to form a National Committee, to organise a service of correspondents, and to give a grant towards the Bureau. A Committee of the British Association has been appointed to consider the matter and report.

Dr. Field also read a paper on the date of publication of zoological papers, in which he urged that the date of *distribution* be adopted as "publication."

Rev. T. R. R. Stebbing gave a paper on economy of labour in zoology, proposing that an effort should be made to gather into a succinct form all the most indispensable knowledge in each branch of zoology.

Prof. G. Gilson (Louvain) described the septal organs of *Owenia fusiformis*; Prof. F. Y. Edgeworth read a paper on the statistics of wasps; and Mr. W. Garstang exhibited a simple and efficient collecting reservoir for the surface tow-net. This tow-net was experimented with on Saturday's dredging expedition, and was found to work very satisfactorily.

On Monday forenoon, Prof. L. C. Miall gave an account (illustrated by the lantern) of our present knowledge of the causes and conditions of insect transformation. He pointed out the fundamental distinction between the metamorphoses of insects and those of other animals. The metamorphoses of marine animals were larval, those of insects adult metamorphoses —the migatory stage being late in the life. In insects the migration was undertaken by the adult, the feeding by the young. This caused considerable difference between these two stages, the adult insect becoming more and more highly organised and specialised and the larva more and more degenerate. This marked contrast brought about the necessity for a quiescent pupa stage between. This paper led to some discussion on metamorphosis.

Dr. H. C. Sorby exhibited a series of marine animals caught in the Suffolk estuaries, and mounted as lantern-slides after various methods of preparation.

Dr. Sorby gave an account of his apparatus for catching minute marine animals, and for estimating the number of organisms in given quantities of sea water.

Dr. E. Frankland read a paper on conditions affecting bacterial life in river water, in which he showed that in a series of monthly observations on the water of the Thames bacteria were more numerous in winter than in summer. There were three conditions which might affect the bacteria, and which he had disentangled, viz. temperature, sunshine, and the volume of water. Sunshine was a powerful germicide, but its effect ceases at a small depth in muddy water. The amount of microbes was found to vary with the amount of flood water. Storage has a very beneficial effect in purifying river water from bacteria.

Prof. A. C. Haddon made an appeal to zoologists to urge upon Government and scientific societies the necessity for an immediate exploration of oceanic islands of the Pacific. He pointed out that the great depths of the sea would remain for long unaltered, that the Antarctic was probably not undergoing any rapid change, but that the fauna and flora of the islands, and the customs of their inhabitants, were all undergoing change from year to year, and therefore ought to receive our first attention.

A paper on the Coccidæ of Ceylon, by Mr. E. E. Green, illustrated by beautiful plates, was read by Prof. Howes.

Dr. H. O. Forbes gave a paper, "Criticisms on some points in the summary of the results of the *Challenger* Expedition," in which he dealt with the supposed greater size of the sun in Carboniferous times, and also with the views of Dr. Murray in reference to the occurrence of similar forms in Arctic and Antarctic regions. Finally he pointed out that the evidence for an Antarctic continent in Tertiary times is really supported by the *Challenger* collections, rather than the reverse, as held by Dr. Murray.

A paper on the marine fauna of Houtman's Abrolhos Islands, West Australia, by W. Saville-Kent, showed that the anomalous character of the fauna of Abrolhos can only be accounted for by the assumption that an ocean current setting in from the equatorial Indian Ocean penetrates as far south as this island group.

Dr. Gregg Wilson read a paper on hereditary polydactylism, and also one on the reproduction of the common crab. Dr. Wilson was of opinion that an increased size limit would be a very distinct protection to the crab. A close time at the end of the year would protect the female at a time when there is most destruction.

On Tuesday, Prof. Lloyd Morgan gave an account of his experiments on instinct in young birds. He reared young moorhens, chicks, &c., for the purpose of determining how far the activities of locomotion (swimming, diving, running, flying), feeding, bathing, &c., are instinctive or congenital, and how far their definiteness is a matter of individual acquisition. It was found that timidity had a congenital basis, but was perfected by individual acquisition. There was no instinctive avoidance of insects with warning colours, but such avoidance was rapidly acquired by the individual. There appears to be little support for the view that what is individually acquired is then passed on by heredity.

Dr. Bashford Dean gave an exhibition of ova and larvæ of *Amia*, *Lepidosteus* and *Acipenser*, with some notes on the early development of the Ganoids, in which he brought out that Embryology supports the views derived from Palæontology. Dr. Dean considers that *Lepidosteus* is the oldest or most primitive, and *Amia* the form which comes nearest to the Teleosts.

Dr. Otto Maas (Munich) discussed some questions relating to the morphology and distribution of Medusæ. He exhibited some plates of supposed deep-sea Medusæ from the *Albatross* expedition showing the prevalence of a purplish tint, which he supposed to be the complementary tint to the green phosphorescent light given out by many deep-sea animals.

Mr. J. E. Moore's paper on spermatogenesis in birds, showed that the spermatic elements of pigeons have a marked tendency to form multinucleate masses. The whole course seems to correspond more closely with elasmobranchs than with mammals.

Prof. G. B. Howes read a paper on the mammalian hyoid. He showed that there were two types: (1) Proterostylic, found only in man and marmosets, and (2) Opisthostylic, known only in rabbits and some other rodents. The following papers: On the development of the teeth in certain Insectivora, by M. F. Woodward; on the poison apparatus of certain snakes, by G. S. West; on the value of myology in the classification of animals, by F. G. Parsons; and on ultimate vital units, by Miss Nina Layard, concluded the ordinary sittings of the Section.

A notable feature of the meeting was the very successful dredging expeditions organised for the Zoological Section by the Local Committee, with the help of the President of the Section and Dr. H. C. Sorby. On Saturday a large steamer was chartered from the Railway Company for dredging outside Harwich. Many hauls of the dredge, and of various forms of tow-net, both surface and bottom, were made off the Naze and in the neighbourhood of the Gunfleet bank. Large quantities of material were obtained, including representatives of most groups of the Invertebrata. The specimens picked out were arranged in a number of large glass jars, and on the return journey Prof. Herdman gave a demonstration on the most interesting forms obtained. On Wednesday, the 18th, the second zoological excursion took place, to Wyvenhoe to inspect the Colne Oyster Fishery, by invitation of the Mayor and Corporation of Colchester. The party were taken on board the new steam oyster dredger of the Fishery Board, and hauls of the dredges were obtained at various points in the estuary of the Colne in order to show the condition of the oyster ground. Large quantities of the Polyzoon *Alcyonidium gelatinosum* and of common Ascidians, especially *Ascidiella virginea*, were found associated with the oysters. The steamer then proceeded to the Pyefleet creek, where three millions of the famous Colchester "natives" are now fattening; here the party landed and inspected the packing sheds, where they were entertained to an oyster luncheon. On returning to the steamer, dredging was again carried on further down the estuary, so as to see as much as possible of the ground, and the different ages and conditions of the oyster. Every facility was given to the party for examining this important fishery, and a most favourable impression was received of the healthiness of the ground, the purity of the water, and the excellent condition of the stock.

GEOGRAPHY AT THE BRITISH ASSOCIATION.

THE brilliant International Geographical Congress, recently held in London, seems to have afforded sufficient intellectual dissipation for most British geographers this year, and many familiar faces were absent from Section E. Comparatively few papers were presented for reading, and several of these were read by the Secretaries, as the authors could not attend. It is doubtful whether papers presented in this way should be brought before the Association, for fair discussion is impossible unless the author is present to support his arguments and answer questions.

If Section E retained its usual popularity this year—and the large lecture hall was occasionally crowded—it was not because of the sensational character of the communications made; there was not even a lady-traveller to read a paper. A characteristic of the meeting was the exceptional scientific value of the papers, which dealt less with exploration than with research.

During recent years the President of Section E has almost always been a practical geographer with a commanding knowledge of one branch of his subject, and this year the succession was worthily upheld by Mr. H. J. Mackinder, the Reader in Geography at Oxford, whose experience of higher education in geography enabled him to formulate a scheme for restoring that science to its proper place in a rational university system. The older universities have not responded as was expected to the proposals of the Royal Geographical Society as to the institution of Chairs of Geography; and the time seems to have come for the Society to take a fresh departure, either independently or in conjunction with a new university not blind to the value of the experiment which has been tried and found satisfactory in Germany. A Committee of the British Association has been appointed, without a grant, to investigate the teaching of geography in this country, Mr. Mackinder being chairman and Mr. Herbertson secretary.

The President's contention that geography is not "the science of all things," but a correlating study dealing with the results of all sciences relating to the earth from a special standpoint, was driven home by many of the papers presented to the meeting.

Mr. W. B. Blaikie demonstrated by his greatly-improved cosmosphere the astronomical relations of geography, the combination of a terrestrial globe with a transparent celestial globe on which the constellations are printed, forming a great advance on the old armillary sphere; while the ingenious device of removing a celestial and terrestrial hemisphere allowed of the working of plane problems on the section as readily as of spherical problems on the surface of the outer sphere.

Climatology was discussed in the report of the Committee on the climate of tropical Africa, which was presented by Mr. Ravenstein, the chairman. It shows the results already obtained from the six stations in tropical Africa equipped by the Association. The Committee was reappointed with a small grant and with a change of secretary, Mr. H. N. Dickson taking the place of Dr. H. R. Mill.

Dr. John Murray gave a sketch of the central problem of oceanography—the circulation of the oceans; and the Section instructed the President to write a letter to Dr. Murray, congratulating him on the completion of the *Challenger* Reports, the most important contribution to physical geography of recent years.

Mr. H. N. Dickson summarised the result of the recent international observations on the North Atlantic, in which he took part, and by the aid of lantern diagrams showed that the distribution of the temperature of the surface-water was intimately associated with the distribution of mean atmospheric pressure over the ocean, and that consequently the temperature of the Atlantic water was an important factor in determining the weather as well as the climate of Western Europe.

Mr. A. Trevor Battye read an interesting paper on the struggle for existence in Arctic regions, dealing with biogeographical problems, but unfortunately there was no time to discuss it. A biological discussion which greatly pleased the audience, but was perhaps somewhat inappropriate to the Section, arose on Mr. Borchgrevink's paper describing his recent experiences in the far South, and a proposed plan for a private Antarctic expedition. Sir Joseph Hooker, the veteran of Ross's Antarctic voyages, who was received with great enthusiasm, referred to his adventures in the Antarctic seas, and while congratulating Mr. Borchgrevink on his work in the Norwegian whaling trip, expressed little hope of great results following a private expedition. Sir William Flower had the meeting with him in declaring that no more attempts should be made to send out ships on the pretext of looking for whales or seals, but with the hope of gaining scientific information.

The return to Vardö of the *Windward*, after landing Mr. Jackson in Franz-Josef Land, occurred during the meeting, and Mr. Montefiore, Secretary of the Jackson-Harmsworth expedition, gave a brief account of the start of the land party.

In the historical aspect of geography, Mr. J. L. Myres contributed a discussion of the maps of Herodotus, which enabled an interesting contrast to be drawn between the *à priori* methods of the ancient world and the scientific inductions of to-day.

The papers descriptive of exploration dealt with Africa and Asia. Captain Hinde's experiences in the Congo State, and Mr. G. F. Scott-Elliot's admirable expedition for the scientific study of the Ruwenzori region, have already been before the public in other forms. Mr. H. S. Cowper's journey through Tarhuna and Gharian in Tripoli was new, and the archæological features which he observed seem to be deserving of further study.

The Rev. W. Weston gave one of the most valuable travel-papers—an account of his explorations in the Japanese Alps. This range occupies the centre of the largest island, with summits rising to elevations of over 10,000 feet. The snowfall on the western side is enormous on account of the moisture in the prevailing wind, while the eastern side of the range remains comparatively free of snow. Although the snow-line in summer is as low as 7000 feet in places, there are no signs of glacial action. The volcanic mountains abound in hot mineral springs of high repute as baths, and ores of copper and silver are mined in several places. The flora and fauna are both rich, and the people retain their ancient politeness and hospitality, while many curious customs and beliefs survive amongst them.

Mr. John Dodd, who was not able to be present, sent an exhaustive memoir on Formosa, where he had resided from 1864 to 1890. As a trader he had been much in contact with the aboriginal tribes of the interior, and he gave a graphic account of